**Investigating the buffering capacity of solutions with various West Lake water: drinking water volume ratios**

**Aim:**

To investigate the relationship between the volume ratio West Lake water and drinking water and the number of 1 molar HCl droplets required to turn the pH levels of each solution to 4 on the meter to determine the varying buffering capacities.

**Hypothesis:**

*If* a solution has a higher content of West Lake water than drinking water, *then* it will take more drops of HCl to turn the pH level to 4 *because* the West Lake water has a higher buffering capacity than drinking water and so can withstand more acid infiltration.

**Variables:**

*Table 1: Variables*

|  |  |  |
| --- | --- | --- |
|  | **Variables** | **How will this be manipulated/measured?** |
| Independent | The volume ratio of West Lake water to drinking water | First manipulation: 50:0 (West Lake: drinking water)  (volume in cm3 : volume in cm3)  Second manipulation: 40:10  Third manipulation: 30:20  Fourth manipulation: 20:30  Fifth manipulation: 10:40  Sixth manipulation: 0:50 (drinking: West Lake) |
| Dependent | The buffering capacity of the West Lake water and drinking water sample | The buffering capacity is calculated by subtracting the number of HCl droplets required to turn a pure 50 cm3West Lake water sample to 4 on the pH meter from the amount of HCl droplets required to turn the West Lake water: drinking water solution to 4 on the pH meter. |
| Control 1 | * + The length of time the lake water: drinking water solution is mixed for | Each solution should be mixed for exactly 10 seconds in the Erlenmeyer flask plugged by a rubber stopper.  Mix solution for 10 seconds with every addition of HCl droplets. |
| Control 2 | * + The area from which the West Lake water is extrapolated | The water should be taken from the same 1 m2 segment of the lake, by the edge of the lake |
| Control 3 | * + Type of drinking water used | All water should be from (BRAND) |
| Control 4 | * + pH meter used | The same pH meter should be used throughout the trials, with washes between every trial. |
| Control 5 | * + Concentration of acid | HCl 1 mole is the acid that will be added, droplet at a time, to the solution. |
| Control 6 | * + Placement of pH meter during measuring | The pH reading should be taken when the pH meter is suspended in the solution with the meter not touching any of the sides of the flask. |

**Materials:**

* 2 50 mL graduated cylinders (±1ml)
* 6 Erlenmeyer flasks
* 6 rubber stoppers
* 400 mL of drinking water
* 400 mL of West Lake water
* 300 mL of 1 molar HCl
* pH probe (±.005)
* 1 electronic balance (±.005 grams)
* 1 pipette

**Procedure:**

1. Measure out 50mL of West Lake water into a graduated cylinder.
2. Place the pH meter into the flask, and take a reading, waiting until the meter has settled on one number for over 5 seconds.
3. Add one drop of HCl at a time to the soil using a pipette, mixing for 10 seconds between additions.
4. Record the number of drops it takes for the pH level of the soil solution to drop to 4.
5. Repeat step 1-3, replacing 50 mL of West Lake water for 40 mL.
6. Measure out 10mL of drinking water in the graduated cylinder.
7. Add this water to the Erlenmeyer flask containing 40 mL of lake water.
8. Plug the flask with a rubber stopper and mix thoroughly for 10 seconds.
9. Repeat steps 5-6 with the new solution.
10. Repeat steps 7-11 with 30 mL of lake water and 20 mL of pool water.
11. Repeat steps 7-11 with 20 mL of lake water and 30 mL of pool water.
12. Repeat steps 7-11 with 10 mL of lake water and 40 mL of pool water.
13. Measure out 50 mL of pool water in a graduated cylinder.
14. Pour the 50 mL into an Erlenmeyer flask and take an initial pH reading, record.
15. Repeat steps 5-6 with the pure pool water sample.
16. Repeat steps 1-17 until three trials have been completed for each manipulation of the independent variable or repeat until consistent results are obtained.

**Data Collection:**

**Trial:** What I discovered upon doing the trial run of this lab, is that due to the extremely acidic nature of 1 molar HCl, the solutions were very quick to respond in pH levels to the addition of this acid. The data collection below is from a lab conducted with 1 molar HCl, however, for the final experiment it is recommended to use 0.2 molar HCl which will entail more accurate data.

*Table 2: The number of HCl droplets required to turn the pH levels of various lake:drinking water solutions to 4.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Ratio of West Lake water to drinking water** | **Number of HCl drops required to turn pH level to 4:**  **TRIAL ONE** | **Number of HCl drops required to turn pH level to 4:**  **TRIAL TWO** | **Number of HCl drops required to turn pH level to 4:**  **TRIAL THREE** |
| Lake water - **50** mL  Drinking water - **0** mL |  |  | Not completed in trial run due to material limitations. |
| Lake - **40** mL  Drinking -**10** mL |  |  | " |
| Lake - **30** mL  Drinking - **20** mL |  |  | " |
| Lake - **20** mL  Drinking - **30** mL |  |  | " |
| Lake - **10** mL  Drinking - **40** mL |  |  | " |
| Lake - **0** mL  Drinking - **50** mL |  |  | " |

\*First = initial pH reading of the solution